

# **Appendix F**

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## **Paleontological Resources Memorandum**



January 25, 2024

Anne Marie McGraw, Project Manager  
Insignia Environmental  
545 Middlefield Road, Suite 210  
Menlo Park, California 94025  
Transmitted via email to [amcgraw@insigniaenv.com](mailto:amcgraw@insigniaenv.com)

**RE: Paleontological Resource Technical Memorandum for the Manning 500/230 Kilovolt (kV) Substation Proposed Project, Fresno County, California**

Dear Anne Marie McGraw,

At the request of Insignia Environmental, PaleoWest, LLC dba Chronicle Heritage (Chronicle Heritage) conducted a paleontological resource assessment for the proposed LS Power Grid California, LLC (LSPGC) Manning 500/230 kV Substation Project (Proposed Project) in Fresno County, California. The goal of the assessment was to detail the results of a literature review and museum records search, summarize the paleontological sensitivity of the geologic units of the Proposed Project area and alternatives, assess potential impacts from Proposed Project implementation for adverse effects to scientifically significant paleontological resources under California Environmental Quality Act (CEQA) guidelines, and provide management recommendations for avoiding or reducing adverse effects to paleontological resources from the Proposed Project development as necessary.

This paleontological resource assessment included a fossil locality records search conducted by the Natural History Museum of Los Angeles County (NHMLAC). The records search was supplemented by a review of existing geologic maps and primary literature regarding fossiliferous geologic units within the Proposed Project vicinity and region. This technical memorandum, written in accordance with the guidelines set forth by the Society of Vertebrate Paleontology (SVP) (2010), has been prepared to support environmental review under CEQA.

## Project Location and Description

The Proposed Project is located in sections 23-26 and 36, Township (T) 15 South (S), Range (R) 12 East (E); sections 22, 26-33, and 35, T15S, R13E; sections 25-30, T15S, R14E; and sections 4-6 and 8-9, T16S, R13E, Mount Diablo Baseline and Meridian as depicted on the Chaney Ranch, Levis, Monocline Ridge, and Tumey Hills, California 7.5-minute U.S. Geological Survey (USGS) topographic quadrangles (Figure 1 and Figure 2). The main components of the Proposed Project include:

- Construction of an approximately 12-acre (ac) 500/230 kV substation (hereafter referred to as the proposed LSPGC Manning Substation);
- Construction of an approximately 12-mile (mi)-long double-circuit 230 kilovolt (kV) line from the proposed LSPGC Manning Substation to Pacific Gas and Electric Company's (PG&E's) existing Tranquillity Switching Station (hereafter referred to as the proposed LSPGC 230 kV Transmission Line);



- Interconnection of the following PG&E lines into the proposed LSPGC Manning Substation;
  - Los Banos-Midway #2 500 kV Transmission Line and Los Bano-Gates #1 500 kV Transmission Line (approximately 0.75 mi each)(hereafter referred to as the proposed PG&E 500 kV Interconnections);
  - Panoche-Tranquillity Sw. Sta. (short for switching station) #1 and #2 230 kV Transmission Lines (approximately 4.2 mi each)(hereafter referred to as the proposed PG&E 230 kV Interconnections);
- Rebuild of approximately 7 mi of PG&E's existing Panoche-Tranquillity Sw. Sta. #1 and #2 230 kV Transmission Lines (hereafter referred to as the proposed PG&E 230 kV Rebuild)

The proposed LSPGC Manning Substation would occupy approximately 12 ac. LSPGC has secured an exclusive option to purchase up to 40-ac for the proposed LSPGC Manning Substation within an approximately 160-ac parcel. An approximately 550-foot (ft)-long, 20-ft-wide new driveway and a detention basin would be constructed along with the proposed LSPGC Manning Substation. The permanent access road and detention basin would be located outside of the walled portion of the substation. Construction at the proposed LSPGC Manning Substation site would begin by clearing all vegetation within the site, grading it to create a generally flat area, and constructing the permanent access road to the substation. The below-ground components (e.g., ground grid and equipment foundations) would then be installed, followed by the substation and telecommunication components. Lastly, testing and commissioning would be conducted once the transmission lines were terminated at the proposed substation prior to energization.

The proposed LSPGC 230 kV Transmission Line would be approximately 12 mi in length within an approximately 120-ft-wide right-of-way. Temporary access roads would be required to provide access to some structures and construction areas. New permanent access roads may be constructed for access to structures, where needed, based on engineering design and landowner feedback. Construction of the access roads would involve vegetation clearing and grading, as required, to create a flat area to facilitate construction.

The proposed LSPGC 230 kV Transmission Line, PG&E 230 kV Interconnections, and PG&E 230 kV Rebuild would be constructed using predominantly self-supported double-circuit tubular steel monopoles with a vertical conductor configuration and two overhead optical ground wires. Typically, 230 kV transmission structures range from 70 to 180 ft in height and could be up to 199 ft tall when crossing other infrastructure. The proposed PG&E 500 kV Interconnections would be constructed on single-circuit lattice steel towers and tubular steel pole structures at some angle points. The 500 kV structures for the Proposed Project would typically be larger than the 230 kV structures, ranging between 100 and 160 ft in height. Typical structures would be supported on either concrete pier foundations or direct-bury foundations. Where required, dead-end and angle structures would also be supported using guy wires and anchors. In addition, modifications to PG&E's existing Tranquillity Switching Station as well as the Los Banos, Panoche, Gates, and Midway substations would be completed as part of the proposed Project.

Alternative alignments for the Proposed Project are included in this assessment and shown in Figure 2.



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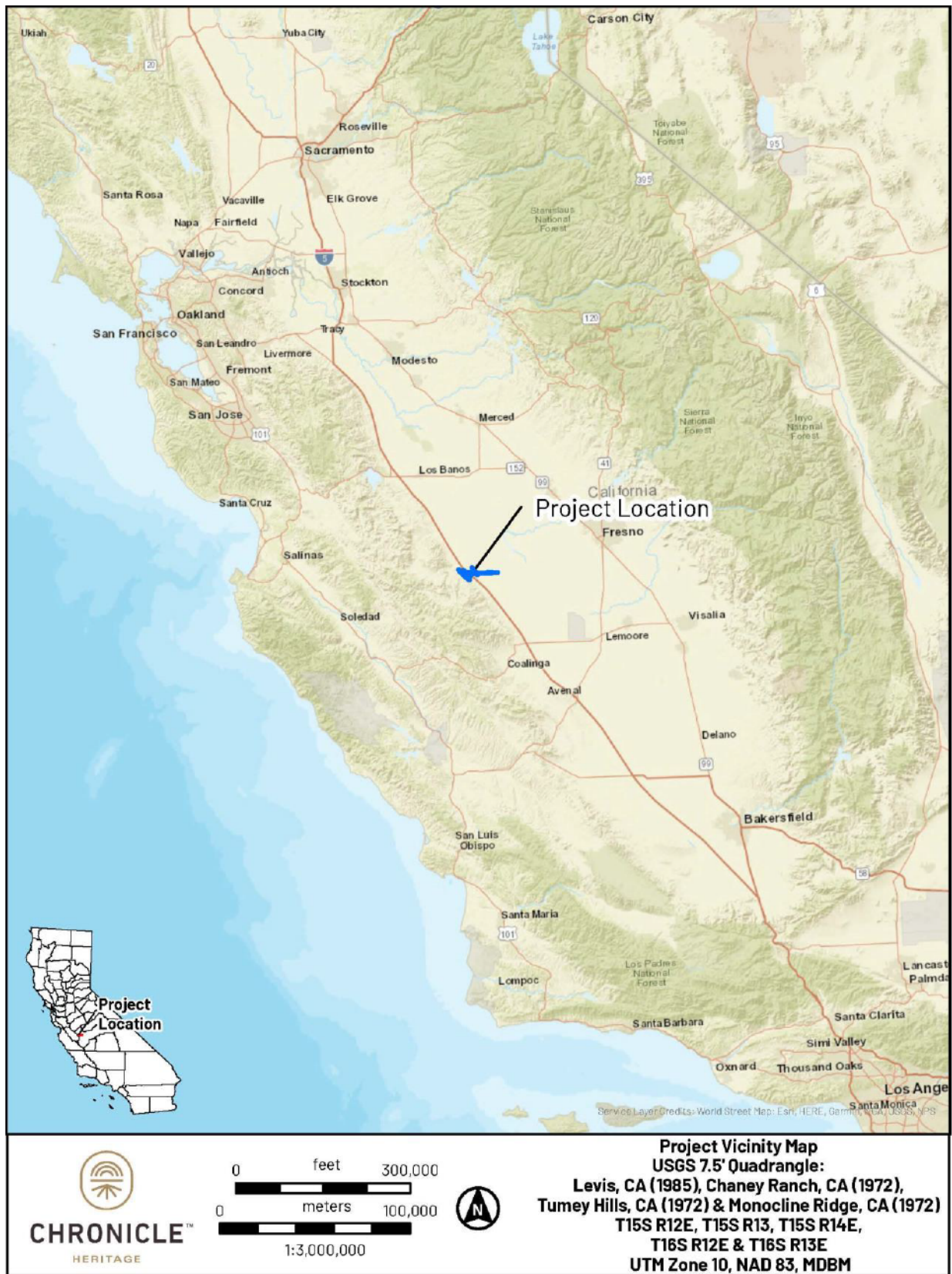


Figure 1. Proposed Project vicinity map.



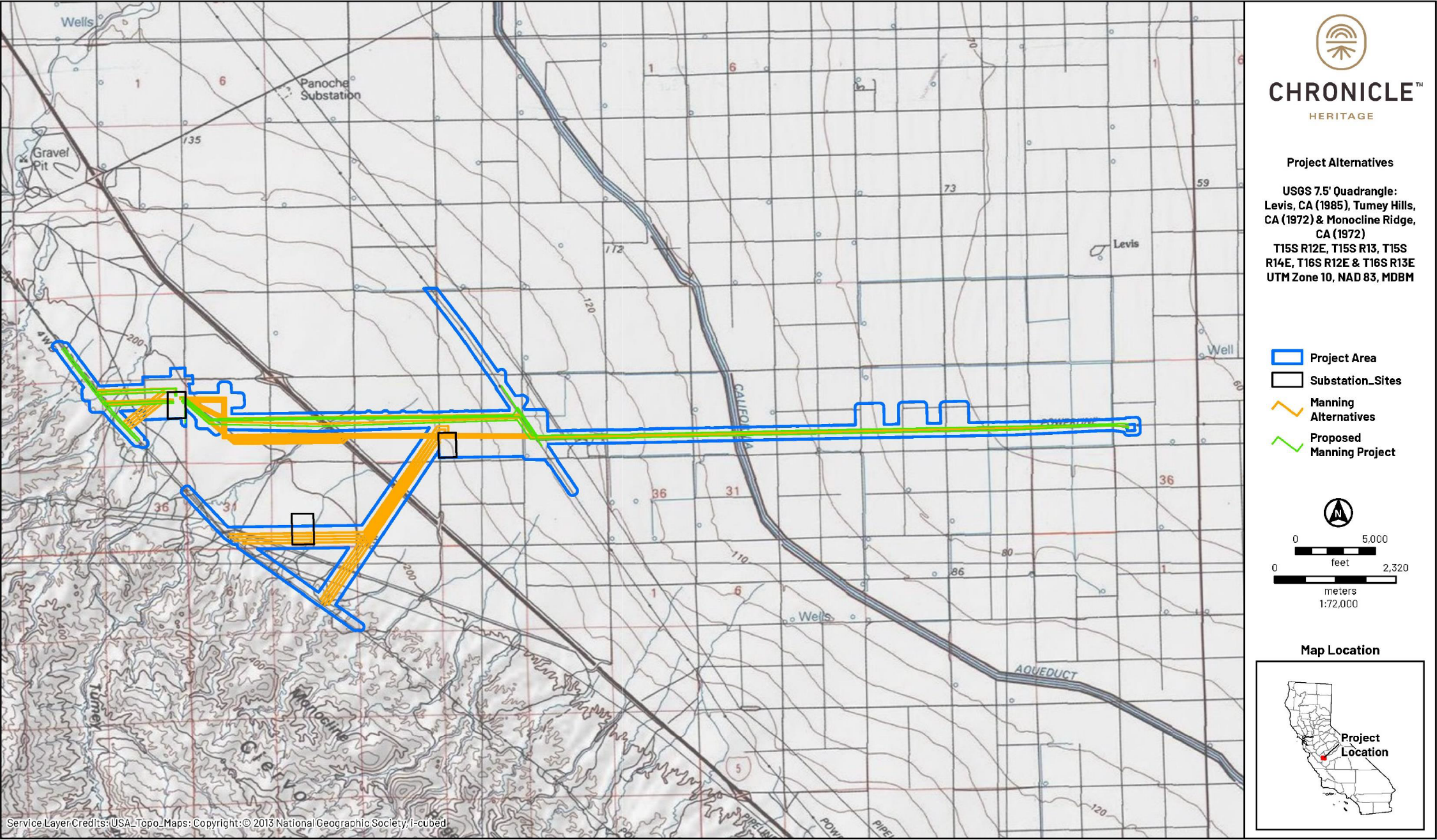


Figure 2. Proposed Project location map.



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## Regulatory Context

Paleontological resources (i.e., fossils) are considered nonrenewable scientific resources because, once destroyed, they cannot be replaced. As such, paleontological resources are afforded protection under various federal, state, and local laws and regulations. Laws pertinent to this Proposed Project are discussed below.

### State Laws and Regulations

#### California Environmental Quality Act

CEQA requires that public agencies and private interests identify the potential environmental consequences of their projects on any object or site of significance to the scientific annals of California (Division I, California Public Resources Code [PRC] Section 5020.1[j]). Appendix G in Section 15023 provides an Environmental Checklist of questions (Section 15023, Appendix G, Section XIV, Part A) that includes the following: "Would the project directly or indirectly destroy a unique paleontological resource or site or unique geological feature?"

#### California Public Resources Code

Section 5097.5 of the PRC states:

No person shall knowingly and willfully excavate upon, or remove, destroy, injure, or deface any historic or prehistoric ruins, burial grounds, archaeological or vertebrate paleontological site, including fossilized footprints, inscriptions made by human agency, or any other archaeological, paleontological, or historical feature, situated on public lands, except with the express permission of the public agency having jurisdiction over such lands. Violation of this section is a misdemeanor. As used in this PRC section, 'public lands' means lands owned by, or under the jurisdiction of, the state or any city, county, district, authority, or public corporation, or any agency thereof.

Consequently, public agencies are required to comply with PRC 5097.5 for their activities including construction and maintenance as well as for permit actions (e.g., encroachment permits) undertaken by others.

### Local

The Fresno County General Plan, Open Space and Conservation Element (Fresno County, 2000) establishes the following goals and policies with respect to paleontological resources:

**Goal OS-J** To identify, protect, and enhance Fresno County's important historical, archeological, paleontological, geological, and cultural sites and their contributing environment.

**Policy OS-J.1** The County shall require that discretionary development projects, as part of any required CEQA review, identify and protect important historical, archeological, paleontological, and cultural sites and their contributing environment from damage, destruction, and abuse to the maximum extent feasible. Project-level mitigation shall include accurate



site surveys, consideration of project alternatives to preserve archeological and historic resources, and provision for resource recovery and preservation when displacement is unavoidable.

## Paleontological Resources

### Paleontological Resource Definition

SVP has provided guidance designed to support state and federal environmental review. The SVP broadly defines significant paleontological resources as follows:

Fossils and fossiliferous deposits consisting of identifiable vertebrate fossils, large or small, uncommon invertebrate, plant, and trace fossils, and other data that provide taphonomic, taxonomic, phylogenetic, paleoecologic, stratigraphic, and/or biochronologic information. Paleontological resources are considered to be older than recorded human history and/or older than middle Holocene (i.e., older than about 5,000 radiocarbon years). (SVP, 2010)

Significant paleontological resources are determined to be fossils or assemblages of fossils that are unique, unusual, rare, diagnostically important; or are common but have the potential to provide valuable scientific information for evaluating evolutionary patterns and processes; or that could improve our understanding of paleochronology, paleoecology, paleophylogeography, or depositional histories. New or unique specimens can provide new insights into evolutionary history; however, additional specimens of even well-represented lineages can be equally important for studying evolutionary patterns and processes, evolutionary rates, and paleophylogeography. Even unidentifiable material can provide useful data for dating geologic units if radiometric dating is possible. As such, common fossils (especially vertebrates) may be scientifically important and therefore considered significant.

This definition is used for all projects that are subject CEQA since CEQA does not define "a unique paleontological resource or site."

### Paleontological Resource Potential

Absent specific agency guidelines, most professional paleontologists in California adhere to the guidelines set forth by SVP (2010) to determine the course of paleontological mitigation for a given project. These guidelines establish protocols for the assessment of the paleontological resource potential of underlying geologic units and outline measures to mitigate adverse impacts that could result from project development. Using baseline information gathered during a paleontological resource assessment, the paleontological resource potential of geologic units, or members thereof, underlying a project area can be assigned to one of four categories defined by SVP (2010). Although these standards were written specifically to protect vertebrate paleontological resources, all fields of paleontology have adopted the following guidelines.

#### High Potential (Sensitivity)

Rock units from which significant vertebrate or significant invertebrate fossils or significant suites of plant fossils have been recovered have a high potential for containing significant nonrenewable fossiliferous resources. These units include but are not limited to sedimentary formations and some volcanic formations that contain significant nonrenewable paleontological resources

anywhere within their geographical extent and sedimentary rock units temporally or lithologically suitable for the preservation of fossils. Sensitivity comprises both (a) the potential for yielding abundant or significant vertebrate fossils or for yielding a few significant fossils, large or small, vertebrate, invertebrate, or botanical and (b) the importance of recovered evidence for new and significant taxonomic, phylogenetic, ecologic, or stratigraphic data. Areas that contain potentially datable organic remains older than recent, including deposits associated with nests or middens, and areas that may contain new vertebrate deposits, traces, or trackways are also classified as significant.

### **Low Potential (Sensitivity)**

Sedimentary rock units that are potentially fossiliferous but have not yielded fossils in the past or contain common and widespread invertebrate fossils of well-documented and understood taphonomic, phylogenetic species, and habitat ecology are considered to have a low potential for containing significant nonrenewable fossiliferous resources. Reports in the paleontological literature or field surveys by a qualified vertebrate paleontologist may allow a determination that some areas or units have a low potential for yielding significant fossils before the start of construction. Generally, these units will be poorly represented by specimens in institutional collections and will not require protection or salvage operations. However, as excavation for construction is underway, it is possible that significant and unanticipated paleontological resources might be encountered and require a change of classification from low to high potential and thus require monitoring and mitigation if the resources are found to be significant.

### **Undetermined Potential (Sensitivity)**

Specific areas underlain by sedimentary rock units for which little information is available have undetermined fossiliferous potentials. Field surveys by a qualified vertebrate paleontologist to determine the rock units' potential are required before programs of impact mitigation for such areas can be developed.

### **No Potential**

Rock units of metamorphic or igneous origin are commonly classified as having no potential for containing significant paleontological resources.

## **Methods**

To assess whether a particular area has the potential to contain significant paleontological resources in the subsurface, it is necessary to review published geologic mapping to determine the geology and stratigraphy of the area. Geologic units are considered sensitive for paleontological resources if they are known to contain significant fossils anywhere in their extent. Therefore, a search of pertinent local and regional museum repositories for paleontological localities in and within 3 mi of the Proposed Project area is necessary to determine whether fossil localities have been previously discovered within a particular rock unit. For the Proposed Project, a records search was requested of the NHMLAC collections. Records searches were also conducted of the online University of California Museum of Paleontology (UCMP) Collections, Paleobiology Database, FAUNMAP, iDigBio, and other published and unpublished geological and paleontological literature of the area.

## Resource Context

### Geologic Setting

The Proposed Project area is in the southern portion of the Great Valley geomorphic province. The Great Valley is a 50 mi wide by 400 mi long alluvial plain in the central part of California that has accumulated sediment since the Jurassic Period (201–145 Ma) (California Geological Survey [CGS], 2002). The present-day Great Valley was once covered by marine waters, during which time marine and nonmarine shale, sandstone, and conglomerate of the Cretaceous Period (145–66 Ma) Central Valley Sequence was deposited (Bartow and Nilsen, 1990). When the Great Valley region began subsiding in the Paleocene Epoch (66–56 Ma), marine continental shelf sediment was deposited above the Great Valley Sequence (Barron, 1989; Graymer et al., 1996; Harden, 1998). By the beginning of the Pliocene Epoch (5.3–2.58 Ma), most of the marine waters in the Great Valley were drained, and an orogenic (i.e., mountain-building) episode occurred in the vicinity of the present-day Coast Ranges (Weissmann et al., 2005), resulting in extensive deposition of terrestrial material, including alluvial fans and fluvial sediments in the Great Valley (Norris and Webb, 1976). The present-day Great Valley is greatly influenced by two rivers, with the northern portion of the valley, the Sacramento Valley, being drained by the Sacramento River and the southern portion of the valley, the San Joaquin Valley, drained by the San Joaquin River (CGS, 2002). The depth of the sedimentary deposits, combined with associated orogenic uplift and faulting, has produced extensive oil fields particularly in the southernmost San Joaquin Valley and along anticlinal uplifts on its southwestern margin (CGS, 2002).

Locally, the Proposed Project area is immediately east of the Diablo Range, a mountain range in the California Coast Ranges that extends approximately 200 mi from Contra Costa County south to Monterey County and generally consists of rolling hills and grasslands (Norris and Webb, 1976). The Proposed Project area is situated on sedimentary basin deposits that have been shed off the uplifted and tilted Tumey Hills and Panoche Hills to the southwest (Bartow, 1990; Minisini and Schwartz, 2007). The Cenozoic deposits in the valley are diverse, recording both local tectonic activity and global sea-level change (Bartow, 1990).

### Site Specific Geology and Paleontology

The geology of the Proposed Project area is mapped by Chin et al. (1993) at a scale of 1:250,000 (Figure 3). The Proposed Project area is underlain by the following geologic units: Tulare Formation (QTnt) and younger alluvium (Qya) (Chin, et al. 1993). The geologic units in the Proposed Project area are described in the following sections.

#### **Tulare Formation (QTnt) (Pliocene–Pleistocene)**

The Tulare Formation (QTnt) was defined at the Kettleman Hills near the old shoreline of Tulare Lake (Woodring et al., 1940). The unit is approximately 1,700 to 3,500 ft thick and is intermittently exposed from the eastern flank of the Diablo Range to the center of the Great Valley (Bartow, 1991). The Tulare Formation (QTnt) consists of westward-thickening alluvial fan conglomerate, fluvial sandstone, and interbedded lacustrine siltstone and clay deposits that drained from the Coast Ranges during the Pliocene and Pleistocene Epochs (Bartow, 1991). In the vicinity of the Proposed Project area, the Tulare Formation (QTnt) is composed of clay, silt, and gravel at the foothills of the Tumey Hills and Panoche Hills (Chin et al., 1993). The Tulare Formation (QTnt) is mapped within the westernmost portion of Proposed Project area near the proposed PG&E 500 kV Interconnections.



No permanent structures associated with the proposed PG&E 500 kV Interconnections would be located within the formation; however, a pulling site associated with the proposed PG&E 500 kV Interconnections would be located in an area underlain by the formation. In addition, the Tulare Formation (QTnt) is mapped along the southernmost alternative alignment in the foothills of the Diablo Range. The surface exposure of this geologic unit may be obscured by up to 60 inches of soil development (USDA and NRSC, 2000). Elsewhere in Fresno County, the Tulare Formation (QTnt) has produced remains of mammoth, bony fish, and freshwater invertebrates (SDNHM, 2023; UCMP, 2023).

### Younger alluvium (Qya) (Holocene)

Younger alluvium (Qya) in the Proposed Project area is composed of diverse unconsolidated deposits ranging in size from clay to boulder deposited in the Holocene Epoch (11,700 years ago to present) (Chin et al., 1993). Most of the Proposed Project area is located on the flat-lying younger alluvium (Qya) in the valley floor, which was deposited in various fluvial, lacustrine, alluvial, and eolian processes (Chin et al., 1993). Holocene deposits are typically too young to have accumulated or preserved significant biological material but may overlie older Pleistocene deposits with the potential to preserve significant paleontological resources.

## Records Search Results

The NHMLAC records search did not produce any fossil localities from within the Proposed Project area, but did produce several localities in similar deposits in the vicinity of the Proposed Project from the Tulare Formation (QTnt) (Bell, 2023) (Attachment A). No localities were identified for the mapped younger alluvium (Qya). Searches of online databases and other literature did not produce any additional localities within 3 mi of the Proposed Project area (Miller, 1971; Jefferson, 1991a, 1991b; Graham and Lundelius, 2010; iDigBio, 2023; Paleobiology Database, 2023; UCMP, 2023) (Table 1).

**Table 1. Vertebrate Localities Documented in Vicinity of proposed Project**

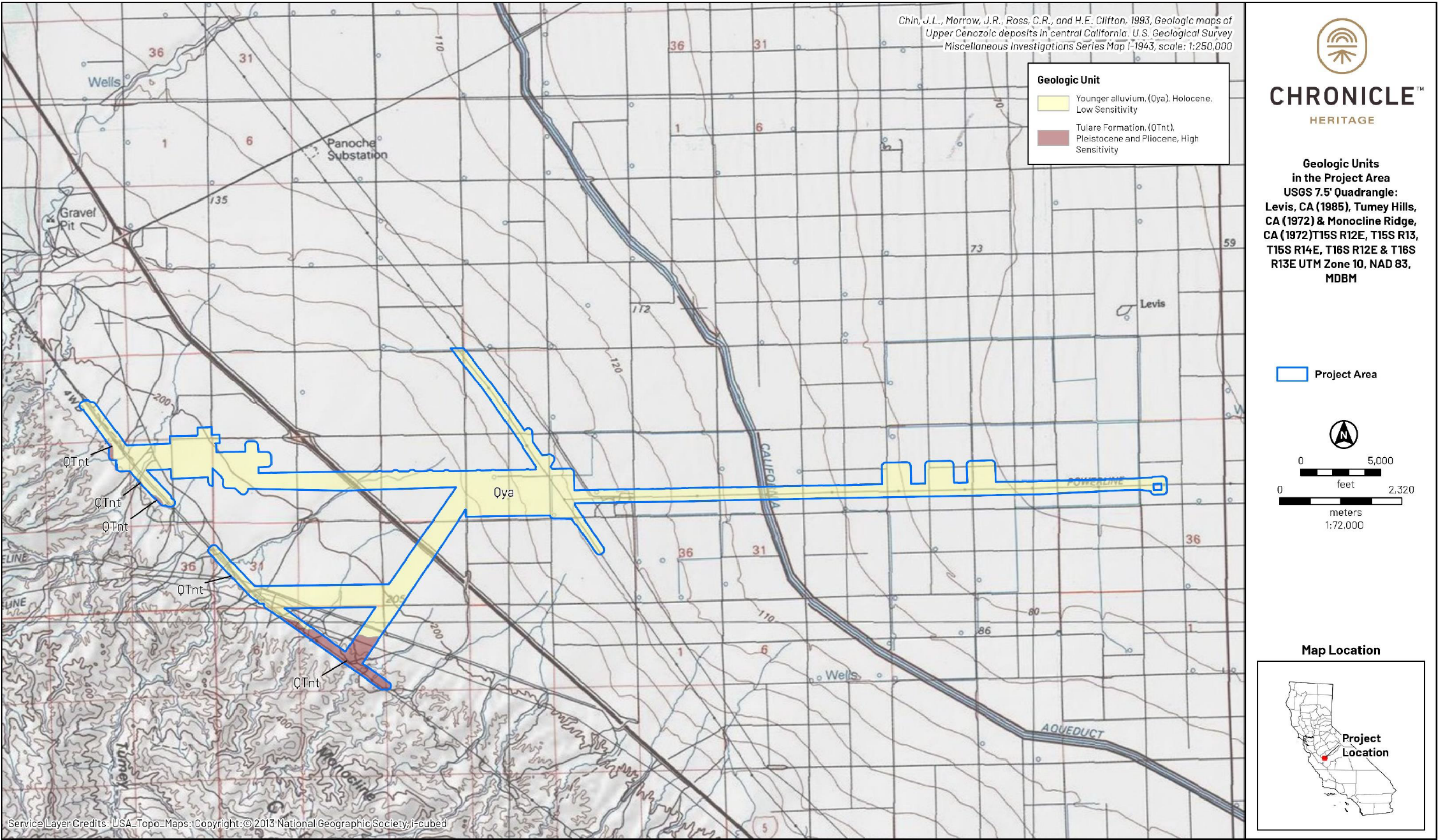
Locality No. <sup>1</sup>	Age	Formation	Taxa	Depth	Distance
LACM IP 29829	Pliocene–Pleistocene	Tulare	Invertebrates (uncatalogued)	Surface	7 mi SE
LACM VP 3505, CIT 348	Pliocene–Pleistocene	Tulare	Short-faced bear ( <i>Tremarctinae</i> ), horse ( <i>Equus</i> ), camelid ( <i>Camelidae</i> )	Surface	15 mi NW

<sup>1</sup> Bell (2023).

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**Figure 3. Proposed Project geology map.**

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## Findings

This memorandum uses the SVP (2010) system to assess paleontological sensitivity and the level of effort required to manage potential impacts to significant fossil resources. Using this system, the sensitivity of geologic units was determined by the relative abundance and risk of adverse impacts to vertebrate fossils and significant invertebrates and plants.

Based on the literature review and museum records search results, and in accordance with the SVP (2010) sensitivity scale, the Tulare Formation (QTnt) has a high paleontological sensitivity because similar deposits have yielded significant fossils in the vicinity. The younger alluvium (Qya) has a low paleontological sensitivity (Table 2). Because of the presence of fossil localities in the vicinity, Proposed Project ground disturbance related in the Tulare Formation (QTnt) has the potential to impact paleontological resources. No permanent structures associated with the proposed PG&E 500 kV Interconnections would be located in an area underlain by the formation; however, a pulling site associated with the proposed PG&E 500 kV Interconnections would be located within an area underlain by the formation. Pulling site preparation would potentially involve surface disturbance, including grubbing and limited grading, that would have the potential to impact paleontological resources if present. No other portions of the Proposed Project are located within the Tulare Formation (QTnt).

**Table 2. Geologic Units in the Proposed Project Area and their Paleontological Sensitivity**

Geologic Unit	Map Abbreviation <sup>1</sup>	Age	Typical Fossils <sup>2</sup>	Paleo Sensitivity
Younger alluvium	Qya	Holocene	Low potential for fossils in Holocene-age sedimentary deposits	Low
Tulare Formation	QTnt	Pliocene-Pleistocene	Short-faced bear ( <i>Tremarctinae</i> ), horse ( <i>Equus</i> ), camelid ( <i>Camelidae</i> ), invertebrates	High

<sup>1</sup> Chin et al (1993)

<sup>2</sup> Bell (2023)

## Recommendations

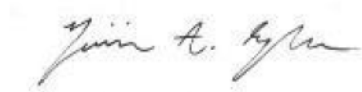
In general, the potential for a given project to result in negative impacts to paleontological resources is directly proportional to the amount of ground disturbance associated with the project; thus, the higher the amount of ground disturbances within geological deposits with a known paleontological sensitivity, the greater the potential for negative impacts to paleontological resources. The presence of high sensitivity units at the surface in the Tulare Formation (QTnt) suggests that ground disturbance may result in significant impacts to paleontological resources, including destruction, damage, or loss of scientifically important paleontological resources, under CEQA. Pulling site preparation would potentially involve surface disturbance, including grubbing and limited grading, potentially within the Tulare Formation (QTnt). To avoid and/or minimize potential effects, a qualified paleontologist should be retained to develop and implement the measures recommended below. These measures have been developed in accordance with SVP guidelines; if implemented, these measures will satisfy the requirements of CEQA.

## Pre-Construction Survey

Prior to the commencement of pulling site preparation and use in the Tulare Formation (QTnt), a field survey of the mapped deposits of Tulare Formation (QTnt) is recommended to determine the distribution, lithologic composition, and depth of the Tulare Formation (QTnt) and to evaluate the deposits for their potential to contain preserved fossil material at the subsurface. The results of the field survey would assist in determining where paleontological resource mitigation (e.g., fossil salvage and/or paleontological monitoring during construction) may be necessary in areas mapped as Tulare Formation (QTnt). Upon completion of the survey, the qualified paleontologist should prepare a technical memo outlining the results of the survey. The memo should include a discussion of the location and methods of the survey, the stratigraphic data collected, any identified fossils and their scientific significance, and recommended mitigation measures, if any.

Thank you for contacting Chronicle Heritage for this proposed Project. If you have any questions, please do not hesitate to contact us.

Sincerely,  
**Chronicle Heritage**

A handwritten signature in dark ink, appearing to read "Benjamin A. Scherzer", is positioned above the printed name.

**Benjamin Scherzer, M.S.**  
Senior Paleontologist



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**Attachment A.**  
**NHMLAC Record Search Results**



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## Research & Collections

e-mail: [paleorecords@nhm.org](mailto:paleorecords@nhm.org)

August 27, 2023

Chronicle Heritage

Attn: Michaela Adler

re: Paleontological resources for the Manning 500\_230 kV Substation Project (23-0432)

Dear Michaela:

I have conducted a thorough search of our paleontology collection records for the locality and specimen data for proposed development at the Manning 500\_230 kV Substation project area as outlined on the portion of the Tumey Hills, Monocline Ridge, and Levis USGS topographic quadrangles map that you sent to me via e-mail on August 22, 2023. We do not have any fossil localities that lie directly within the proposed project area, but we do have fossil localities nearby from the same sedimentary deposits that occur in the proposed project area, either at the surface or at depth.

The following table shows the closest known localities in the collection of the Natural History Museum of Los Angeles County (NHMLA).

Tulare, temblor

Locality Number	Location	Formation	Taxa	Depth
LACM IP 29829	In large creek nearly midway between Cantua Cr. and Arroyo Hondo	Tulare Formation	Invertebrates (uncatalogued)	Surface
LACM VP 4253*	Monocline Ridge	Temblor Formation (base of the shell breccia limestone)	Record for casts from UCMP locality V-3301	Unknown
LACM VP 5911 – 5913, 5890	Monocline Ridge	Temblor Formation (from a coquina bed)	Sharks ( <i>Charcharocles</i> , <i>Hexanchus</i> ); mammals ( <i>Blastomeryx</i> , <i>Miotapirus</i> , <i>Desmostylus</i> , Delphinoidea, Cetacea, Sirenia, Kentriodontidae, Cetotheriidae). Partially equivalent to UCMP V6866	Unknown
LACM VP 3505, CIT348	Little Panoche Valley	Tulare Formation	Short-faced bear ( <i>Tremarctinae</i> ), horse ( <i>Equus</i> ), camel family ( <i>Camelidae</i> )	Surface, as float



*VP, Vertebrate Paleontology; IP, Invertebrate Paleontology; bgs, below ground surface*

*\*See Vanderhoof 1937. Univ. Calif. Publ. Geol. Sci. 24(8):201; figs. 62-65 for air photos; stratigraphic section & description*

This records search covers only the records of the NHMLA. It is not intended as a paleontological assessment of the project area for the purposes of CEQA or NEPA. Potentially fossil-bearing units are present in the project area, either at the surface or in the subsurface. As such, NHMLA recommends that a full paleontological assessment of the project area be conducted by a paleontologist meeting Bureau of Land Management or Society of Vertebrate Paleontology standards.

Sincerely,

A handwritten signature in black ink that reads "Alyssa Bell". The signature is written in a cursive, flowing style. The first name "Alyssa" is written in a larger, more prominent script, and the last name "Bell" is written in a slightly smaller, more compact script. The signature is set against a light gray rectangular background.

Alyssa Bell, Ph.D.  
Natural History Museum of Los Angeles County

enclosure: invoice